# Chi-Square Test Analysis for Part-Time Work and Academic Achievement

## (a) Null and Alternative Hypotheses

\*\*Null Hypothesis (H₀):\*\* There is no association between the average number of hours spent working part-time per week and students' perception of the effect on academic achievement.

\*\*Alternative Hypothesis (H₁):\*\* There is an association between the average number of hours spent working part-time per week and students' perception of the effect on academic achievement.

## (b) Conditions for Chi-Square Test

For a chi-square test of independence to be valid, the following conditions must be met:

1. \*\*Random sampling\*\*: The data come from a simple random sample of 200 students from the population of over 20,000 university students, so this condition is met.

2. \*\*Independence\*\*: Each observation is independent of the others, as one student's response doesn't affect another's. This condition is met.

3. \*\*Expected cell counts\*\*: All expected cell counts should be at least 5. From the output, the smallest expected count is 6.825 (for "Positive" effect in ">20 hours" category), so this condition is met.

4. \*\*Sample size\*\*: The total sample size (n=200) is sufficiently large for the chi-square approximation.

All conditions for performing a chi-square test are satisfied for these data.

## (c) Conclusion Based on Chi-Square Test Results

From the computer output:

- Chi-Square statistic = 13.938

- Degrees of freedom = 4

- P-value = 0.007

Since the p-value (0.007) is less than the standard significance level of 0.05, we reject the null hypothesis. There is sufficient evidence to conclude that there is an association between the average number of hours spent working part-time per week and students' perception of the effect on academic achievement.

Looking at the data pattern, we can observe that:

- Students working fewer hours (<11 hours/week) tend to report more positive or no effects

- Students working more hours (>20 hours/week) tend to report more negative effects

## (d) Potential Type of Error

Since we rejected the null hypothesis, the advisory board might have made a \*\*Type I error\*\*.

A Type I error in this context would mean concluding that there is an association between hours worked and perceived academic effects when, in reality, no such association exists in the population of all students at the university.

In practical terms, this would mean the advisory board might implement policies or make recommendations based on a perceived relationship between work hours and academic achievement that doesn't actually exist among the broader student population. This could lead to misallocating resources or creating unnecessary restrictions on student employment.

The probability of having made this Type I error equals the significance level used for the test, which is typically 0.05 (5%). However, with a p-value of 0.007, the probability of a Type I error is actually only 0.7%, making it a relatively unlikely scenario.